Title:	**Anaerobic Digestion of Several Biomasses and New Strategies to Treat the Organic Fraction of Municipal Solid Waste for Biogas Production**

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Abstract: The biogas plants at farm level are good candidates for treating organic residues of both municipalities and the agro-industrial sector in a cost-effective way, and in providing territorially diffused electric and thermal power. Industrial and agro-industrial by-products and residues, animal manures and various types of organic wastes (i.e. source separated organic wastes, lignocellulosic materials, crop residues, vegetable oils, animal fats, protein-rich waste, pre-digested wastewater sludge, animal slurries and manures, waste paper, household waste) were analyzed to evaluate their suitability as substitutes for energy crops in biogas production. Swine manure is always included as a basic substrate in the feeding mixtures, because many of the Italian biogas plants are connected to farms when the organic fraction of municipal solid waste (OFMSW) and olive oil sludge were used as possible solutions such as glycerine from biodiesel production.
Anaerobic co-digestion of a variety of residual biomasses may be a good integrated solution, particularly with wastes that are unsuitable for direct disposal on land. Thus, the substitution or integration of energetic crops with this type of residual biomass in biogas production would allow more independence to the biogas plants from public support, aid in cost reduction, biomass recycling, and fuller integration between agrarian and industrial sectors.
Modern anaerobic digestion (AD) plant treating OFMSW in liquid or dry condition could be suffering from accumulation of high concentration of volatile fatty acids during the initial stage of anaerobic digestion subsequently affect the methanogenic stage in single stage anaerobic reactors. Therefore, two-phase anaerobic digestion systems were developed to permit different bacterial enrichment in two different reactors by providing optimal growth conditions for initial acidogenic and later methanogenic. High investment costs and more complex management characterize this installation. In order to accomplish the phase separation a hybrid bioreactor was designed and applied on pilot scale for treating OFMSW. Hydrolysis was performed in solid condition using liquid recirculation; the percolate is submitted to AD process showing a high methanogenic performance and stability of the process respect standard technologies applied at full scale. Costs are reduced due to its simple design, easy process control and low investment cost than a two stage AD plant.